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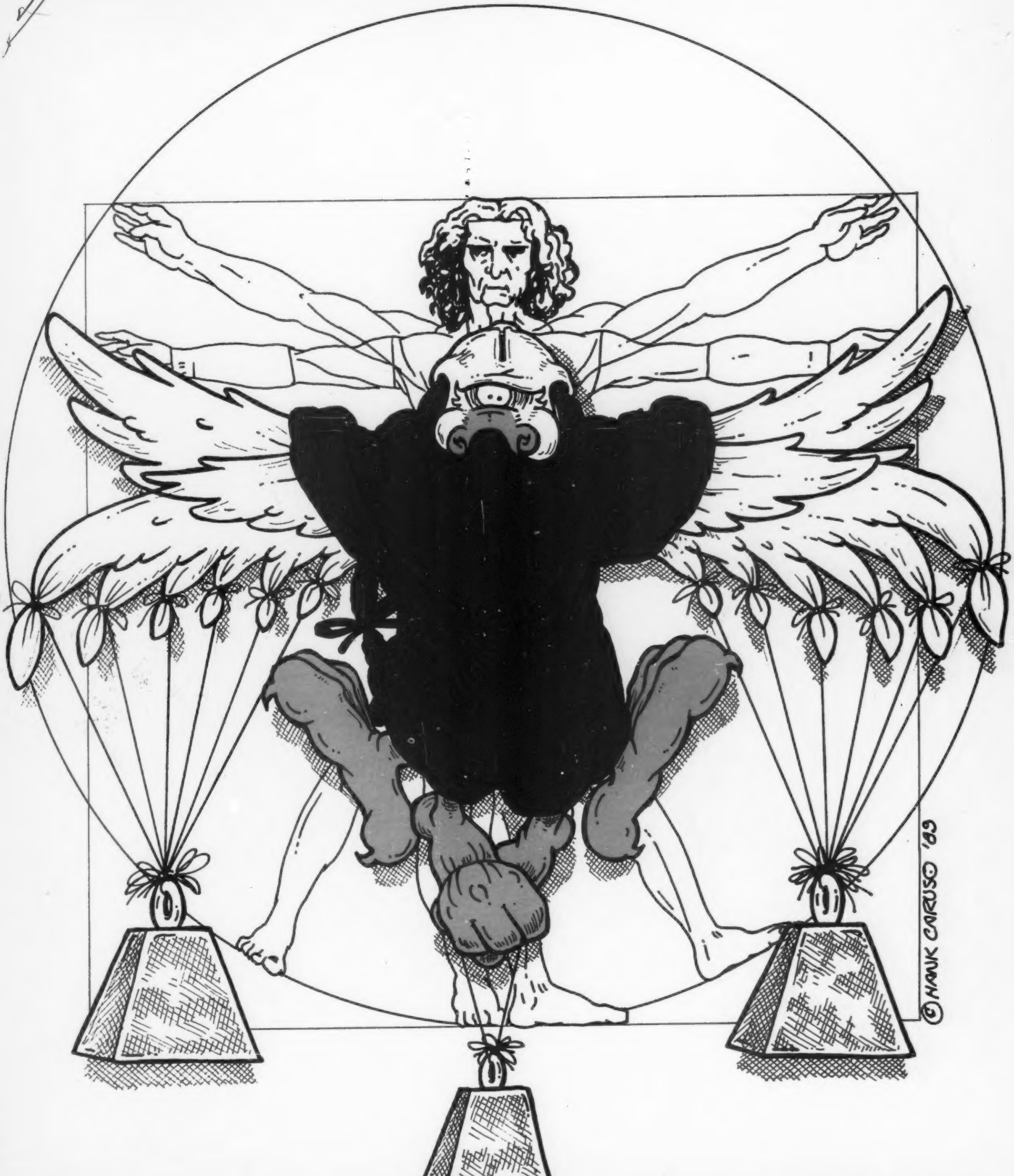
approach

The Naval Aviation Safety Review

UNITED STATES NAVY



Aeromedical Special

Editorial

"Well, Lieutenant, it looks like you're fine."

"Heck, Doc. I could've told you that. Now what are we going to do about the bag-ex I missed by hanging around here all day?"

Many aviators feel an annual flight physical is a waste of time. We all know it is, at best, a break-even proposition. The flight surgeon's main function seems to be to inconvenience savvy flyers. From the first visit to NAMI, we learn that the medical community goes out of its way to adversely influence an aviator's future.

If the sentiment above rings true to you then perhaps you need to read this issue carefully. This issue is dedicated to aeromedicine because in spite of the efforts of the medical community, message boards still tell of aircrew who tried to beat the system and got hurt.

An aviator with a history of high blood pressure ignored his body's warning signs, blaming what felt like heartburn on a Mexican meal the evening prior. He dropped dead at an Air Force base during a refueling stop en route to a missile firing exercise.

LCdr. Mike Dubik's article on page 6 illustrates what can happen when a guy figures he can beat the system. In this case the only one killed was the aviator hiding the medical problem. We need to remember that when we strap into an airplane we're responsible for more than just our own hides. Keeping our health in flying shape is an important facet of taking that responsibility seriously.

Ward Carroll

inside approach

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Artist Hank Caruso, with the help of Leonardo da Vinci, depicts a Naval Aviator weighted down by G-forces.

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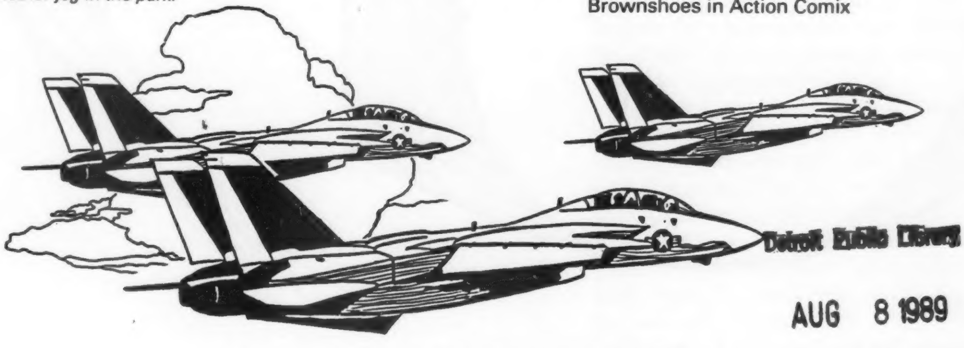

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G Loads: *How To Thrive*

I watched the student aviator as the G load increased. He tightened his stomach muscles as his breathing changed to rapid gasps. He was trying his best to perform the anti-G straining maneuver. Passing through 3 Gs, his leg muscle contractions weakened as he concentrated on gulping more air to restore his fading vision. Soon after the meter hit 4 Gs, his eyes rolled back, his body went limp, and his head dropped down to his chest. The G forces were immediately reduced, allowing the oxygenated blood to quickly return to his brain. Ten seconds passed before his head popped up with his eyes wide open. His right arm twitched uncontrollably upward as consciousness returned. Thirty seconds later, he responded to repeated calls by muttering, "What happened?" Fortunately, this incident occurred in a training centrifuge instead of an aircraft.

During the three minutes it took him to recover, I coached the student on ways to improve his performance. Soon, I watched him perform flawlessly in four runs under peak loads of 8 to 9 Gs. The entire centrifuge training session had taken less than 15 minutes and, in that short time, produced an aircrewman who was now capable of surviving in a high-G environment.

G-Induced loss of consciousness (GLOC) is defined as fainting, brought on by increased G forces. The average time of GLOC following a return to 1 G is 15 seconds; however, some people may need up to 30 seconds before they regain full consciousness.

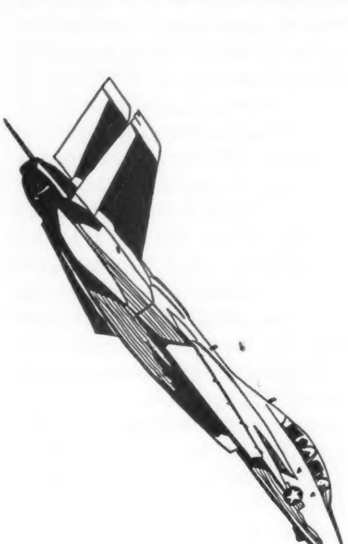
Reports of GLOC were first documented during World War I, and as aircraft technology developed, the problem became increasingly important. By 1932, the Navy had recorded GLOC as an operational hazard during dive-bombing missions. These episodes were described as fainting reactions brought on by centrifugal force encountered during recovery from steep dives.

As aircraft performance advanced, the Navy and Marine Corps became more concerned with the rise in unexplained fatal mishaps in the fighter and attack communities. In 1941, a study identified possible causal factors of these mishaps. This investigation officially recognized GLOC as a physiological phenomenon that caused brief, but total, incapacitation in flight resulting in temporary loss of aircraft control.

After World War II, with the introduction of jet aircraft with their quantum leap in performance, the need for GLOC awareness was reemphasized. With today's generation of high performance types like the F/A-18 and F-16, this concern over GLOC has reached a critical point. The problem is graphically highlighted on a well-known tape of an F-16 training mission. This

e and Survive

By Lt. Fred Patterson, MSC



tape not only documents that total incapacitation can occur in flight, but it also confirms that GLOC results in total loss of aircraft control.

After the loss of several aircraft and aircrew in GLOC-related mishaps, the USAF decided, in 1983, to require high-G centrifuge training for its entire tacair community. This training was well received, with recorded success in preventing GLOC. Over 700 students receive the training every year. Recently, the Navy also recognized the importance of such training and allocated funds for centrifuge training.

The best way to reduce the hazard of GLOC is to understand what happens in the high-G environment. During maneuvers such as high-speed turns, aerobatics and dive recoveries, the body fluids are pressed downward with the most critical effect being a decrease in brain blood pressure. Studies document that an unprepared aviator without a G-suit will likely lose consciousness once the sustained forces have reached a level between 4.5 and 6.3 Gs.

The first indication of GLOC can best be characterized as a sudden loss of consciousness, which, after a return to 1 G, lasts for approximately 15 seconds. During this time, there is a brief waking-up period where the crew member may suffer extreme confusion often compounded by involuntary body movements. There may also be temporary memory loss immediately after a

full recovery. This phenomenon leaves the aviator totally unaware that he has been unconscious and may provide him with a false perception of how well he can deal with the high-G environment.

The combined period of GLOC and recovery with relative incapacitation may last for as long as 45 seconds, plenty of time for an aircraft on a low-level mission to hit the ground with tragic results.

The straining maneuver is one way to increase G tolerance and prevent GLOC. It consists of two components: an aggressive, isometric contraction of the arm, leg and stomach muscles, followed by repetitive breath-holding for three seconds.

The contraction of the arm and leg muscles squeezes the arteries, veins and tissues to reduce blood pooling in the extremities during high-G maneuvering. The result is an increase in blood return to the heart with a corresponding rise in oxygen delivery to the brain. Contraction of the abdominal muscles works similarly by pressing the abdominal organs upward, against the diaphragm. This force increases output pressure from the heart, thereby providing additional brain blood pressure.

Blood pressure from the heart to the brain can also be greatly increased by the cyclic breathholding, which makes up the second portion of the anti-G straining maneuver. The correct procedures are rapid inhalations held for three seconds, followed by rapid exhalations of one second or less. During the three-second intervals of breathholding, the inflated lungs raise blood pressure by exerting force against the heart. This pressure is lost during expiration, which is why it is so important to complete this phase of the breathing cycle in under one second.

Physical conditioning can also play an important part in fighting GLOC. A recent study indicated the duration of high-G tolerance can be extended 53 percent by an aggressive anaerobic weight training program. The muscle groups that respond to this type of training are the abdominal and bicep muscles, which, not surprisingly, are the same muscles used during anti-G straining maneuvers. The Navy and Air Force teamed up to design an exercise program that offers the greatest benefits for the moderate to high-G environment. A complete description of this program can be found in the USAF Manual USAFSAM-SR-88-1 *Physical Fitness Program to Enhance +Gs Tolerance*. Copies should be available through your Aeromedical Safety Officer (AMSO) or Aviation Physiology Training Unit (APTU).

Although aerobic exercise has proven beneficial in preventing cardiovascular disease, traditional endurance activities, such as jogging, have, in the past, been linked to *decreased* G tolerance. However, more in-depth studies have recently indicated this is not the case. These studies document that running 20 miles per week has no detrimental effect on the ability to tolerate Gs. It is, therefore, recommended that endurance training programs that include moderate running or jogging be encouraged for overall fitness.

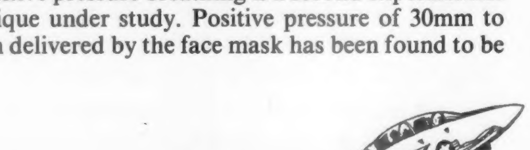
Besides the straining maneuver, the G-suit can give up to 1.6 Gs of protection against GLOC. The G-suit was first developed in 1932, and after several years of testing, it became a standard item for U.S. fighter pilots late in World War II. The suit's design and function has changed little over the years, but research continues.

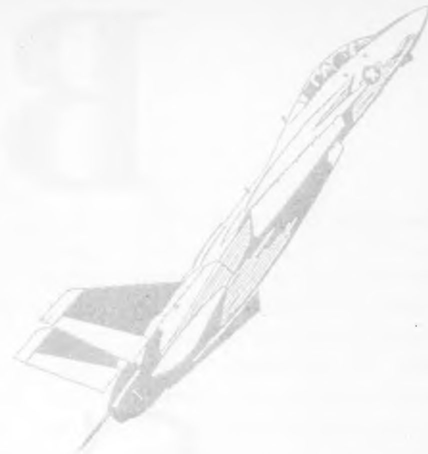
The current version consists of five air bladders, four of which are located over the upper and lower areas of the legs, and one over the abdomen. During maneuvering, the bladders inflate causing peripheral resistance in the legs as well as increased abdominal pressure. The rise in lower body peripheral resistance reduces blood pooling in the extremities and subsequently raises blood pressure to the heart through increased venous return. The result is a rise in available blood pressure to the brain which improves GLOC protection. When a proper straining maneuver is combined with a well-fitted G-suit, centrifuge results indicate an 8-G exposure for 15 seconds can be successfully completed by 99 percent of those tested.

Some evidence suggests that 100 percent oxygen may also improve G tolerance by significantly raising the body's reserve oxygen stores. A healthy adult breathing normal oxygen (21 percent) obtains about 98 percent of his red blood cell (RBC) carrying capability with an additional 3 percent of the total oxygen content being dissolved in the tissues. When 100 percent oxygen is selected, the overall RBC saturation stays about the same; however, the dissolved oxygen pressure increases dramatically from 90 mm Hg. to over 400 mm Hg. This increase in tissue oxygen pressure — which includes the brain — likely expands G tolerance by increasing reserve oxygen stores at the cellular level. Future research will better define the benefits of oxygen and perhaps resolve some of its associated problems such as oxygen atelectasis and postflight ear block.

There are several experimental techniques that may also improve G tolerance. One of these methods is the reclined back seat, such as that used in the F-16. USAF research has demonstrated that a seat reclined 82 degrees will allow an aviator to easily sustain 15 Gs. Obviously, this extreme angle results in an unacceptable loss of visibility. The F-16's seat is tilted 30 degrees, but this still gives G protection while permitting adequate visibility. Centrifuge data indicates the F-16 seat gives approximately 1-G protection over the standard 13-degree aircraft seat.

Positive pressure breathing is a second experimental technique under study. Positive pressure of 30mm to 40mm delivered by the face mask has been found to be

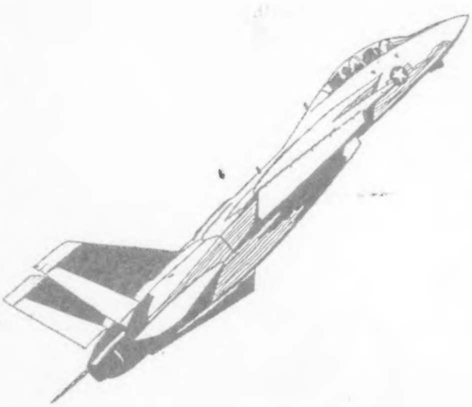




beneficial for not only achieving peak G tolerance, but also reducing fatigue associated with repeated anti-G straining maneuvers. The Air Force reports that, during centrifuge sessions involving between 4.5 and 7 Gs, pilots who used positive pressure breathing were able to tolerate the maneuvers 40 percent longer than those breathing ambient pressure. There is, however, a disadvantage to this approach in that breathing becomes increasingly difficult at higher pressures, unless the subject has undergone specific training for this technique. Since most Navy aircraft are presently equipped with positive pressure breathing systems for protection against hypoxia, it may soon be possible to modify this design for use in the high-G environment.

Negative factors such as dehydration, illness and medication also play an important role in G tolerance. Dehydration affects tolerance by reducing the available blood volume through the loss of body fluids. Under normal circumstances, the majority of the regular daily loss is replaced through routine ingestion of fluids. But, if the body does not retain its optimum fluid balance, dehydration occurs, initially detectable by thirst.

Water is the best way to normally replace and stabilize the fluids in your body, especially when you are in a hot climate. Alcohol should not be used to prevent dehydration; it actually contributes to dehydration. Alcohol becomes a diuretic which increases kidney function and causes frequent urination. Also, the painful hangover that accompanies heavy consumption of alcohol is due, in part, to the resulting fluid imbalance brought on by the diuretic qualities of alcohol.



There are two points to consider when drinking alcohol beverages: Allow a minimum of 12 hours between the last drink and the flight brief (in accordance with NATOPS), and properly replace lost body fluids to minimize the adverse affects that occur with even moderate alcohol consumption.

Caffeine also has a diuretic effect that can produce dehydration. Like alcohol, the effect can be minimized by limiting the intake of these liquids.

Illness will have a serious impact on G tolerance. Again, the major consideration is dehydration, which can easily be brought on by vomiting or diarrhea. Even when these symptoms have been resolved during recovery, it usually takes several days to restore body fluids and return body chemistry to normal. Check with a flight surgeon before returning to flight duty, even after a minor illness.

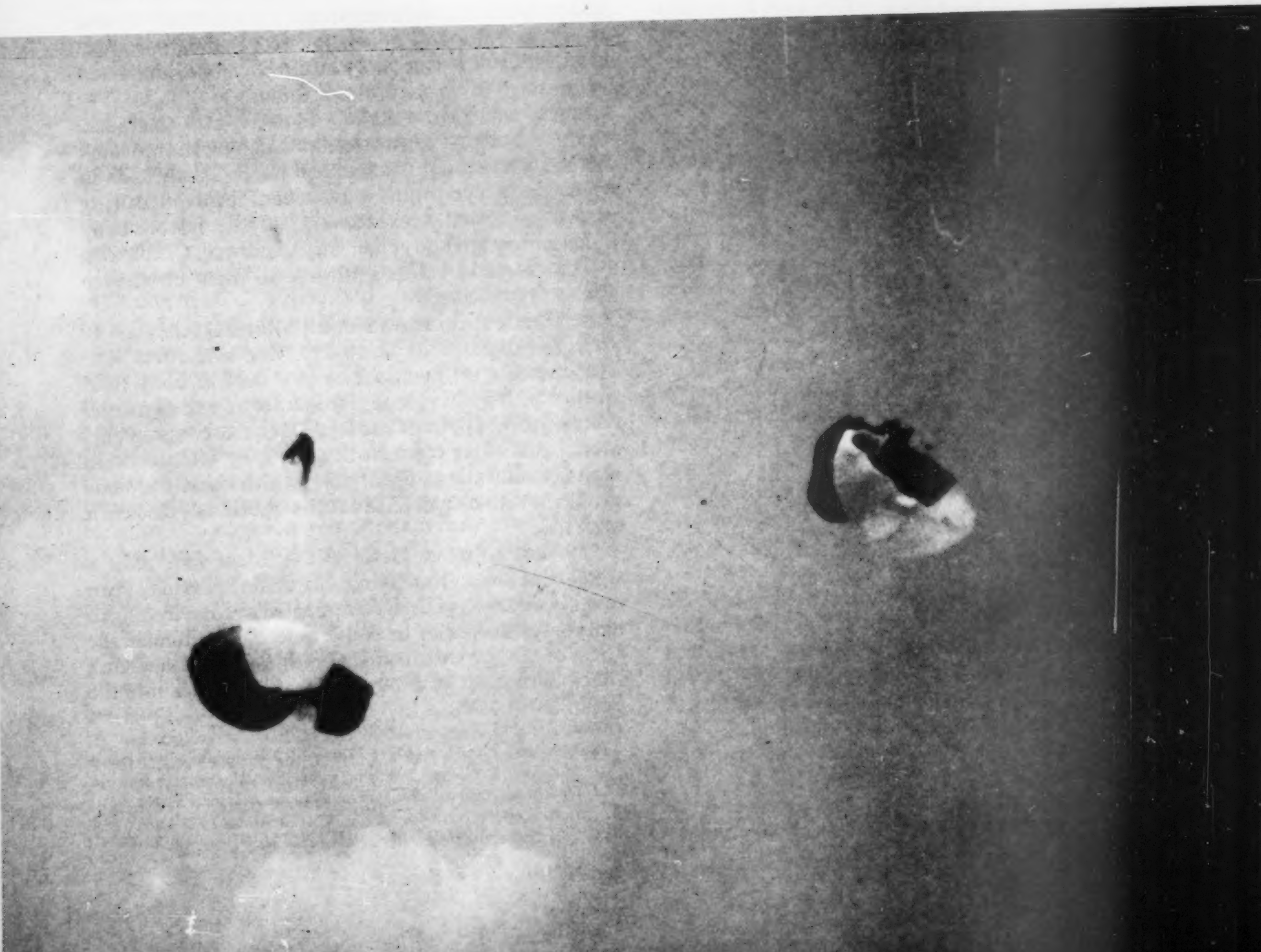
Self-medication also adversely affects G tolerance by altering normal body chemistry. One side affect with over-the-counter medications is a shift in body fluid storage which can reduce G tolerance as well as mental reaction time. Diet aids and legally purchased stimulants are of particular concern because they often contain high concentrations of caffeine, which cause the same problems with dehydration as other previously discussed diuretics.

One last negative factor is the down time after a significant break from flying. Grounding periods of two to three weeks have been documented as contributing to temporary decreases in G tolerance. To minimize the affect of a long break from flying, allow your squadron's "back in the saddle" program to ease you back into the cockpit. ◄

Lt. Patterson served from 1971 to 1974 as an (AW) aircrewman on board P-2 Neptunes and P-3 Orions. Following completion of his master's degree in physiology, he returned to active duty in 1984 as an Aerospace Physiologist. Lt. Patterson now serves with Marine Aircraft Group 14 as Director of Standardization and Safety, and Aeromedical Safety Officer.

Beating the System?

By LCdr. Mike Dubik, MC



Or a man could go for a routine physical one fine day, feeling like a million dollars, and be grounded for fallen arches. It happened! — just like that! (And try raising them.) Or for breaking his wrist and losing only part of its mobility. Or for a minor deterioration of eyesight, or for any of hundreds of reasons that would make no difference to a man in an ordinary occupation. As a result, all fighter jocks began looking upon doctors as their natural enemies. Going to see a flight surgeon was a no-gain proposition; a pilot could only hold his own or lose in the doctor's office. To be grounded for a medical reason was no humiliation, looked at objectively. But it was a humiliation, nonetheless! — for it meant you no longer had that indefinable, unutterable, integral stuff.

THAT'S how Tom Wolfe, in *The Right Stuff,* described the relationship between aviators and their physicians in the 1950s. But we are beyond that today, aren't we? People take their medical care more seriously these days, don't they? The flight surgeon is viewed as a friend who can help you stay "up" and healthy, isn't he? The medical system is on your side, and no one in this day and age would be so shortsighted as to try to beat the system, would he? Think again. The following is based on a mishap that occurred within the past year.

Since his late teens, while at rest, he had experienced occasional sharp pains in his left chest, shoulder and arm, shortness of breath and right-sided headaches associated with blurred vision. In his early 20s he saw a civilian doctor about these complaints, and the doctor noted he had a heart murmur and elevated blood pressure. A series of in-patient and out-patient evaluations were essentially normal except for persistent high-blood-pressure readings. He began taking medication to treat his hypertension.

Just after a visit to his civilian physician, he had his first flight physical examination. He didn't mention his high blood pressure, medication he was on, or the symptoms he had experienced. The medics found his blood pressure to be elevated, so serial readings were taken. The blood pressure readings were progressively lower and on average were within normal limits.

His girlfriend remembered numerous episodes when he was aware of irregular heartbeats while he was resting.

His following flight physicals were all normal with normal blood pressure readings. No noteworthy medical history was revealed on the history portion of any of his flight physicals. The military medical records do not show any evidence of his rather impressive civilian medical history. No flight surgeon was made aware of his civilian hospital admissions for chest pain and headaches, nor of his evaluation by a hypertension specialist.

Shortly after his last flight physical, he had a near-fainting episode in which he felt his heart was beating too fast. He was evaluated at a civilian emergency clinic but did not follow-up with a flight surgeon.

A few weeks later he was the lead pilot of a section night formation training sortie. A few minutes into the flight, he lost consciousness. The back-seater felt the aircraft roll, and when he got no response from the pilot he took control of the aircraft. He contacted the wingman and ground authorities. The pilot was motionless and slumped forward with his head against the canopy, but the back-seater could hear him breathing over the intercom.

After 10 minutes the pilot's condition had not changed. After discussing the situation with his wingman and ground authorities, and because of the pilot's poor body position, the back-seater decided against ejection unless landing proved unsuccessful.

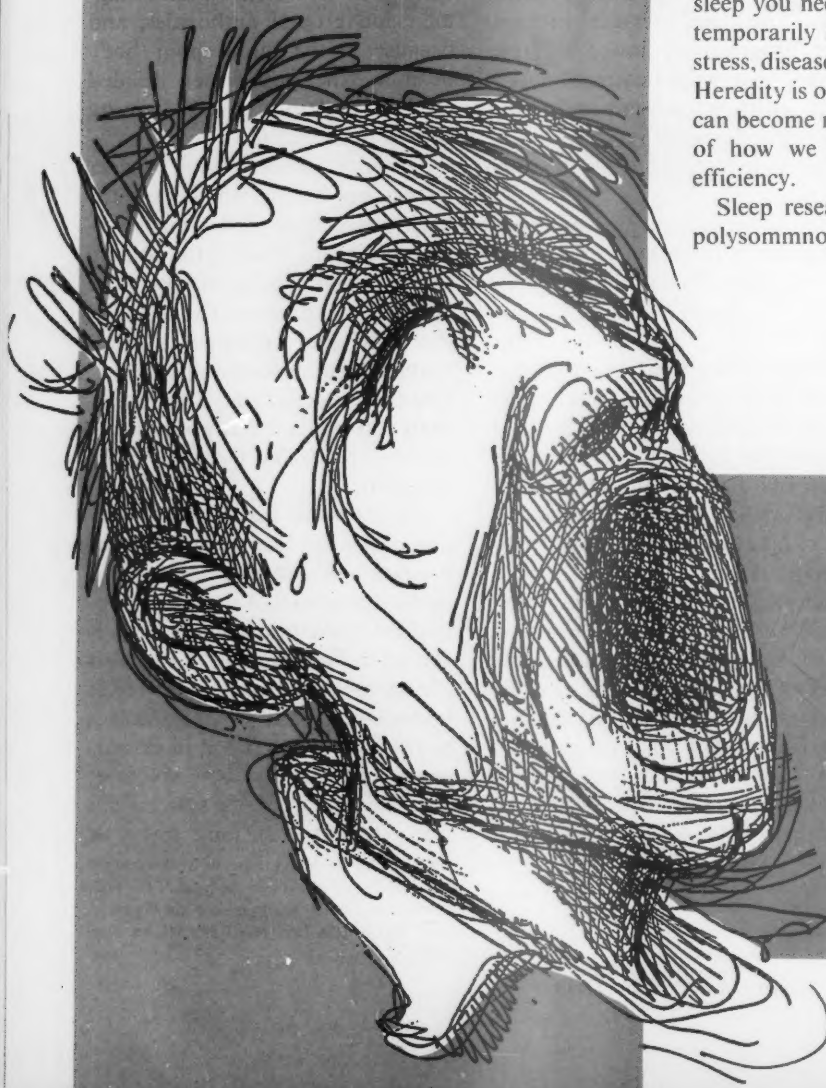
The pilot did not respond for over 30 minutes during which time the back-seater attempted a night formation landing. During the landing the aircraft went off the runway. The landing gear dug into the soil, and the nose gear collapsed. Simultaneously, an uncommanded dual ejection occurred. The back-seater ejected normally with minimal injuries. The ejection killed the pilot.

An extensive medical investigation concluded that the pilot's incapacitation was due to his previous medical condition. A thorough aeromedical evaluation would have prevented this mishap and death. This pilot came close to taking the life of his back-seater and possibly the lives of others as well. Your flight surgeon can't help you unless you let him. You can beat the system, but who gets beat in the long run? ◄

LCdr. Dubik is a flight surgeon assigned to the Naval Safety Center. He is the head of the FSR Analysis Branch. He was previously the flight surgeon for HMLA-269, MAG-29, MCAS New River.

The Combat Nap

By Lt. Randy King



YOUR squadron has been in Alert Alpha around the clock for two days. During the second day of the "war," you actually launch on the 0400-0600 Alert 5. The raid is inbound. You repel the hordes and recover four hours later feeling satisfied that you've done enough for freedom today. As you walk into the ready room, you are met by a grim-faced SDO — he got up for your 0430 launch — who says, "Get some rest. TAO says that was just the first wave. Sicko's med down and you have his alert at 1300." Sound like a bad dream? This aviator's schedule is not all that uncommon. During an exercise, or numerous real-world scenarios, crew rest will be a major problem.

The average person spends nearly a third of his life sleeping. Some people require more sleep than others. Sleep efficiency and heredity determine the amount of sleep you need to function at your peak. Factors that temporarily affect the amount of sleep required are: stress, disease and depression. Sounds like cruise, right? Heredity is one factor you can't change. However, you can become more efficient at sleep. A basic knowledge of how we sleep is important to improving 'sleep efficiency.

Sleep researchers use a laboratory device called a polysommnograph, which records brain waves, muscle

Sleep Stages				
Sleep Stages	**Bodily Activity**	**Depth of Sleep**	**Thought Processes**	**Miscellaneous**
0 Awake	Slows down, decreased muscle tension.	Borderline wakefulness.	Relaxation, mind wanders, awareness dull.	Heart and pulse rates, blood pressure, and temperature slightly diminished.
1	Eyes roll slowly on falling asleep; eyes quiescent in later stage 1 periods. Body movements slowed.	Light sleep; easily awakened; might deny being asleep if awakened.	Drifting thoughts and floating sensation.	Temperature and heart and pulse rates delcine; regular breathing. On occasion, may have hypnogogic hallucinations on falling asleep.
2	Eyes quiet. Few body movements. Snoring is common.	Light to moderate sleep; relatively easy to awaken with moderate intensity sounds. Eyes will not see if opened.	Some thought fragments; memory processes diminished; if awakened, may described a vague dream, but only infrequently.	Decreased heart, pulse and metabolic rates, blood pressure and temperature; regular breathing with increased airway resistance (snoring).
3	Occasional movement, eyes quiet.	Deep sleep; takes louder sounds to be awakened.	Rarely able to remember thoughts; a few vaguely formed dreams; possible memory consolidation.	Metabolic, pulse and heart rates, blood pressure and temperature decrease further. Greater secretion of growth hormone.
4	Occasional movement, eyes quiet.	Deepest sleep; very difficult to awake.	Virtual oblivion, very poor recall of thoughts if awakened. Possibly involved in memory consolidation.	Continued decline in cardiovascular, temperature and metabolic rates; increased secretion of growth hormone probably restores bodily tissues.
REM	Large muscles paralyzed; toes, fingers and small facial muscles twitch; erections; snoring usually ceases.	Variable; if sound incorporated into dream then harder to awake.	80% dreaming, good vivid dream recall especially later in the evening. Possibly involved in unconscious conflict resolution.	Heart rate 5% greater than during NREM; blood pressure and pulse, cerebral blood flow, and metabolic rates increase. Brain temperature increases. Irregular (slow and then fast) breathing; one-half extra breath a minute. Slight increase in body temperature.

Figure 1

activity and eye movement. Other instruments monitor heart beat, breathing rate and body temperature. Figure 1 shows the five stages of sleep. The stages range from the very light (stage 0) to deep sleep (stage 4), to stage 5, the REM (rapid eye movement) sleep.

As we fall asleep, we go rapidly through the stages and their characteristics until we reach stage 4. Stage 4 sleep is characterized on a brain wave meter (EEG) by tall, slow waves called Delta waves. This stage is often called Delta sleep. It is in Delta sleep that the body restorative functions work at full speed. We don't remain in Delta sleep all night; we sleep in cycles.

Figure 2 shows the normal adult sleep stages over an eight-hour period. After the first deep sleep cycle, we rapidly ascend to our first encounter with REM sleep. During the other stages, our bodies are relatively immobile, breathing becomes slow and regular, and our eyes move slowly, if at all. Metabolism attains a rate near that of wakefulness. Brain activity reaches conscious levels, and it is only during REM sleep that we dream. Our bodies are in a very active state during REM sleep, which explains why this stage is sometimes called active sleep. Some scientists even suggest there are three, not two, natural stages of consciousness: wakefulness, non-REM (NREM) sleep and REM sleep.

Figure 2 shows that, as we sleep, we cycle between REM and stage 4 in 90-minute to 110-minute cycles. The longer we sleep, the less time we spend in stage 4 sleep, and thus, more time in the lighter stages and REM sleep. On an average night, we spend about 25 percent of

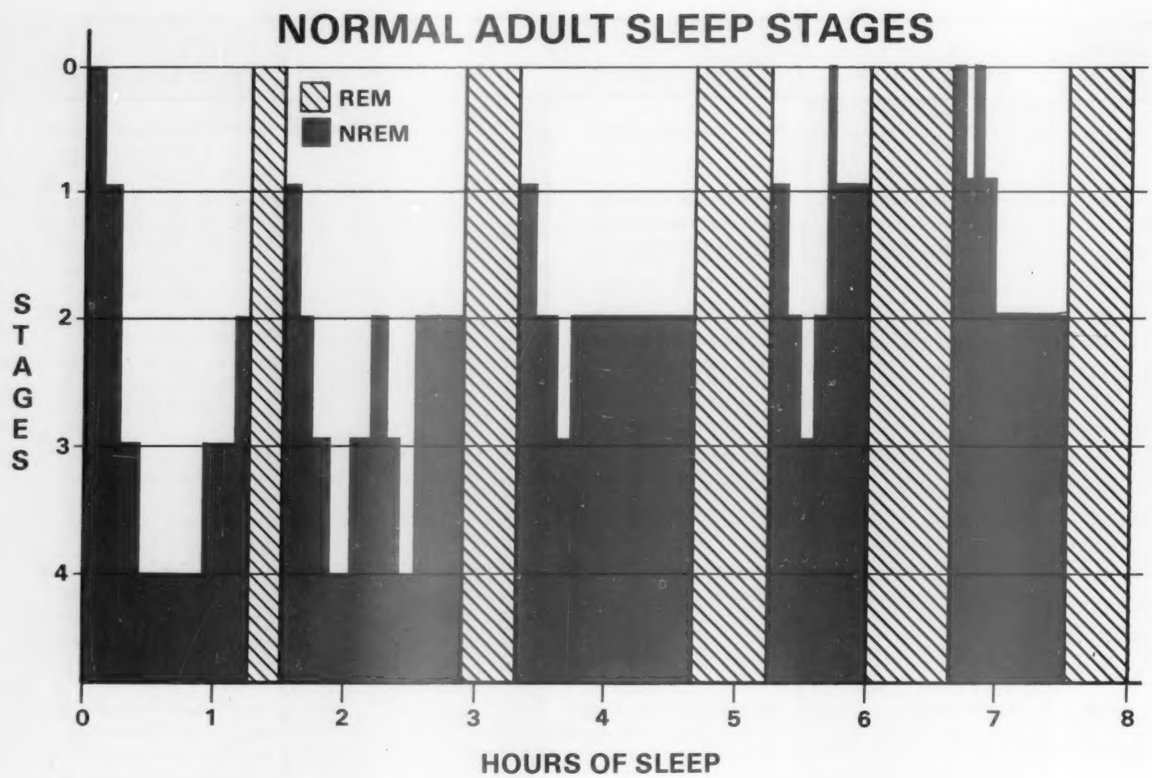


Figure 2

our sleep in REM sleep, 50 percent in stage 2 and only 15 percent in stage 4 sleep. Remaining sleep time is shared between the other two stages.

Ideally, we want to wake from our nap rested, alert and ready to venture back into the fray. We obviously have a limited time with which to accomplish this goal. Our first goal is to get some restoration of the body. We know the body works hardest at restoring itself in stage 4 sleep. OK, we definitely want some of that stage 4 action, and we get the biggest dose during the first hour of sleep. As we continue sleeping, stage 4 cycles shorten and then stop altogether while REM sleep increases.

There is some bad news. Look at Figure 1 to see what kind of shape we'd be in if we woke at the end of our first deep-sleep cycle. We are practically zombies in stage 4 sleep. *If* you hear the phone and the SDO can communicate the fact that it is time to get up, you will feel very tired. You won't be able to think clearly for several minutes because metabolism and body temperature are at their lowest. Your body will be more rested, but you won't feel like it.

On the other hand, if the dreaded wakeup call came 30 minutes later, during a lighter stage or REM sleep, we will wake up feeling more rested. Remember, during REM sleep our bodies are practically awake, anyway. When the phone rings, we wake instantly and jump out of the rack. REM sleep is a good time to be awakened if you want to be alert and up to speed in minimum time. Unfortunately, waking from REM sleep has its problems, too. Researchers find sleepers awakened from REM sleep feel irritable and anxious.

Well, there you have it. The combat nap should last approximately 90 minutes to 110 minutes, with one cycle of deep, restorative sleep. One important factor is the amount of time you take to get to sleep. If it takes longer then 10 minutes, add that time to your nap.

Being well rested is important. As technology improves the machine, the man becomes the major factor in improving our mishap rate. Mishap reports too often quote pilot error and fatigue as contributing factors. It is your command's responsibility to make sure you have crew rest. Your duty is to cry uncle when you don't.

Lt. King is an F-14 pilot with VF-111.

Only a Little Head Cold

By Lt. Bill Norling

SERIOUSLY, it was only a little sinus congestion. I didn't think it would be a problem for this SSC hop. I'd be sure to clear my ears often when taking off and landing. My nose decided on its own to trigger a sneeze in front of the Ops Officer. He told me to see the Flight Surgeon. I felt ready to fly and was confident the Doc would let me.

The Flight Surgeon looked into my ears while I tried to valsalva. I don't know why my ears didn't clear; they worked so well in rehearsal. Despite my best efforts to persuade him otherwise ("We won't go above 5,000 feet," I promised), he pulled out the dreaded down chit. I was crushed.

I wondered why I was down for a simple, little head cold. The Flight Surgeon knew I was bothered, so he gave me some reading matter on the subject. I learned permanent damage could occur if I ruptured a sinus.

There are four sinuses in the head: frontal, maxillary, ethmoid and sphenoid. Most sinus blocks occur in the frontal and maxillary sinuses. Sinuses warm, add moisture to, and partly filter the incoming air before it reaches the lungs. When membranes in the sinus become inflamed from infection, it swells and secretes a watery fluid. As the swelling increases, little pockets of air are trapped in the nasal passages. The amount of fluid trapped produces the familiar heavy, dull feeling in the forehead. As long as the outside air pressure doesn't change quickly, the dull feeling doesn't hurt much.

Most aircraft we fly, however, have performance capabilities that could lead to problems. The air pressure changes quickly as we climb away from the catapult or runway. As the ambient air pressure decreases as we climb, some of the trapped air forces its way past the obstruction, and you feel some discomfort.

During descent the pressure inside the sinus is less than ambient pressure. A vacuum forms and the fragile mucosal lining is stretched. Sometimes the membrane is pulled away from the basal tissue, and a hematoma (bruise or collection of fluid under the skin) is formed.

Another danger of flying with a cold is what happens when those little trapped pockets of air in the nasal passages expand and rupture the membranes. Aside from being extremely painful and potentially incapacitating, the stretched, separated or ruptured membrane allows blood to flow freely into the sinuses.

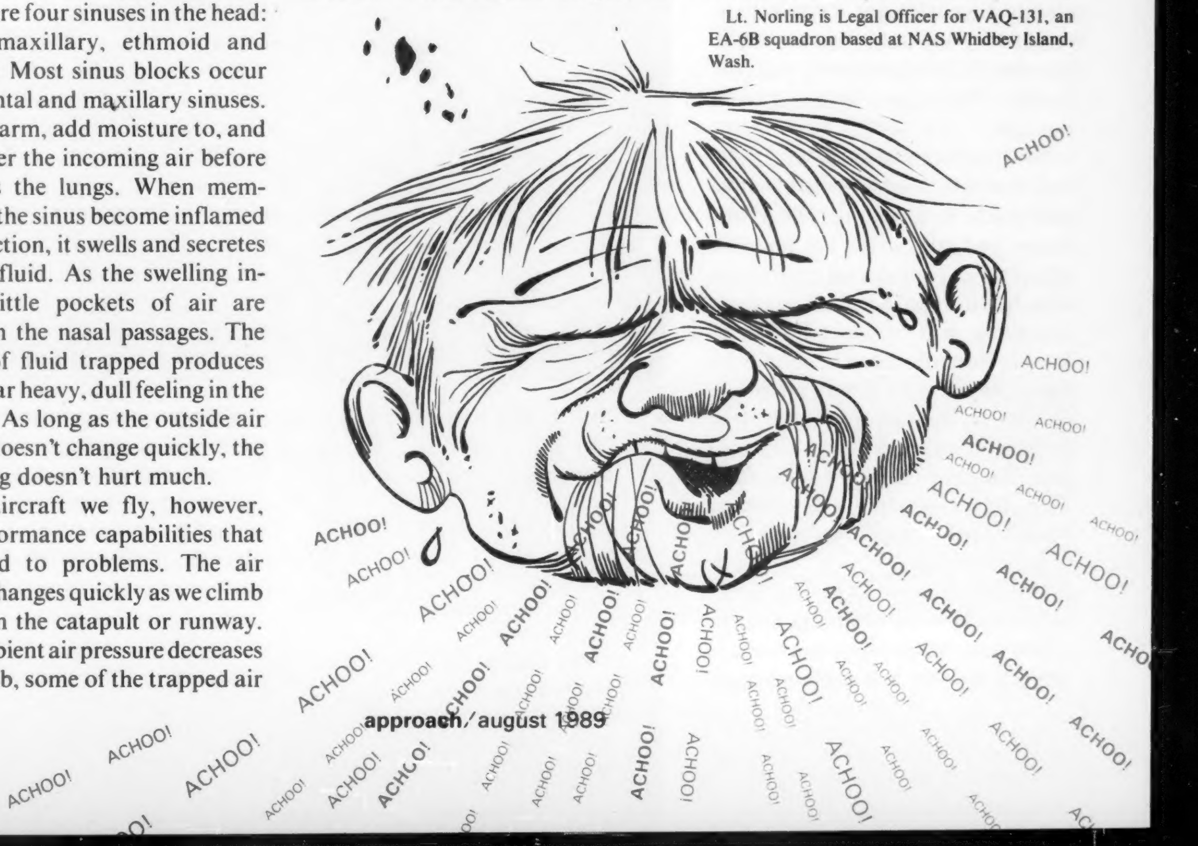
Once the blood accumulates in the sinuses, there is no place for it to go. Unless it drains out on its own accord, it will require surgery to relieve the accumulated fluid. Either way, the amount of trauma to the sinuses will produce more swelling of the tissues. The swelling usually lasts a month.

The Navy Flight Surgeons Manual recommends that an aviator be grounded for at least three weeks in cases where sinus block is suspected. The healing process is monitored by X-rays. The length of down time has been as long as three months in some cases. OPNAVINST 3710.7 requires a low-pressure chamber run to validate that treatment is complete.

A sinus block can reoccur. Treat each case seriously because repeated barotrauma from flying with sinus blocks can result in major surgery and permanent grounding.

After considering these consequences, I decided not to fly with a head cold and risk rupturing a sinus. I'll be able to fly another day. ◄

Lt. Norling is Legal Officer for VAQ-131, an EA-6B squadron based at NAS Whidbey Island, Wash.



Hypoxia: War and Remembrance

By Ltjg. Robert Lamanna, MSC

REMEMBER the first time you went through physiology training in Pensacola? At 25,000 feet, the physiologist told you to remove your mask and to start playing patty-cake with the guy next to you. Two to three minutes later you felt dizzy and tingly, and you couldn't concentrate on your task.

Someone knocked on your helmet. Through the fog you asked yourself, "What does he want? Why is he pointing to my mask? This is fun." Meanwhile, you were slapping your partner in the head instead of his hands.

Suddenly, WHOOOSH! He thrust the mask in your face, and the sweet smell of oxygen filled your lungs. As things got back to normal, you sat quietly and thought "What happened?" At site level, you looked at the video to see how poorly you performed. "So, that's hypoxia!" you thought.

Now, in your aircraft at 35,000 feet, you take your mask off; no one told you to do it. You're feeling fine, happy and cocky. It's hot and you adjust the environmental control system, but it doesn't help. The guy in the plane next to you tells you to keep in formation, but he sounds far away, and you don't pay attention. There's no instructor in your plane to hit you on the helmet and shove that dangling mask in your face. This time, you won't be able to review your performance on a tape. You'll be dead!

Sound familiar? Every year many aircrew experience varying degrees of hypoxia, despite improvements in oxygen delivery and cabin pressuri-

Subjective symptoms
air hunger
apprehension
fatigue
nausea
headache
dizziness
hot/cold flashes
euphoria
belligerence
blurred vision
tunnel vision
numbness
tingling

Objective symptoms
hyperventilation
cyanosis (bluing of lips and fingers)
mental confusion
poor judgement
poor muscle coordination

zation systems, and training.

Hypoxia is a low or decreased oxygen supply to the lungs, blood or tissues. There are four types of hypoxia.

Hypoxic hypoxia is due to two factors. First, there is less oxygen available per breath at higher altitudes; and second, there is reduced pressure to drive that oxygen through the lungs and into the system. Oxygen molecules are widely spread apart at higher altitudes. While you take a breath, there is less oxygen to be drawn in.

Anemic hypoxia is due to the reduced oxygen-carrying capacity of the blood. The most common causes are carbon monoxide poisoning from smoking or exhaust fumes, or a loss of blood. This is why 100 percent oxygen is advisable for tactical jet pilots while taxiing or waiting for clearance to take off at the hold-short position with the canopy open. By the way, there is a general NATOPS rule that people in tactical jet aircraft must be on oxygen from takeoff to landing.

Histotoxic hypoxia occurs when tissues are unable to use the available oxygen. The cause is due mainly to alcohol poisoning. *That's* why NATOPS has things like the 12-hour bottle-to-flight-planning rule.

Stagnant hypoxia is due to the circulatory system's failure to deliver an adequate blood supply and associated oxygen to the brain. This is for the G-pullers out there. The heart's pumping system is impaired, and blood pools in the lower extremities. Anti-G suits and anti-G straining maneuvers are needed here. Also, sitting for long periods during long cross-country flights can produce drowsiness due to blood pooling.

As an aviator or aircrewman, you probably ha‿ the chance to experience hypoxia during training. It is important to remember your *personal* symptoms, recognizing and correcting the problem before it's too late, during the *time of useful consciousness (TUC).* Beyond TUC you can't do anything to help yourself, even if you are awake. Between euphoria and muscle incoordination, correcting the situation is very difficult. Here is a small table showing TUC for various altitudes.

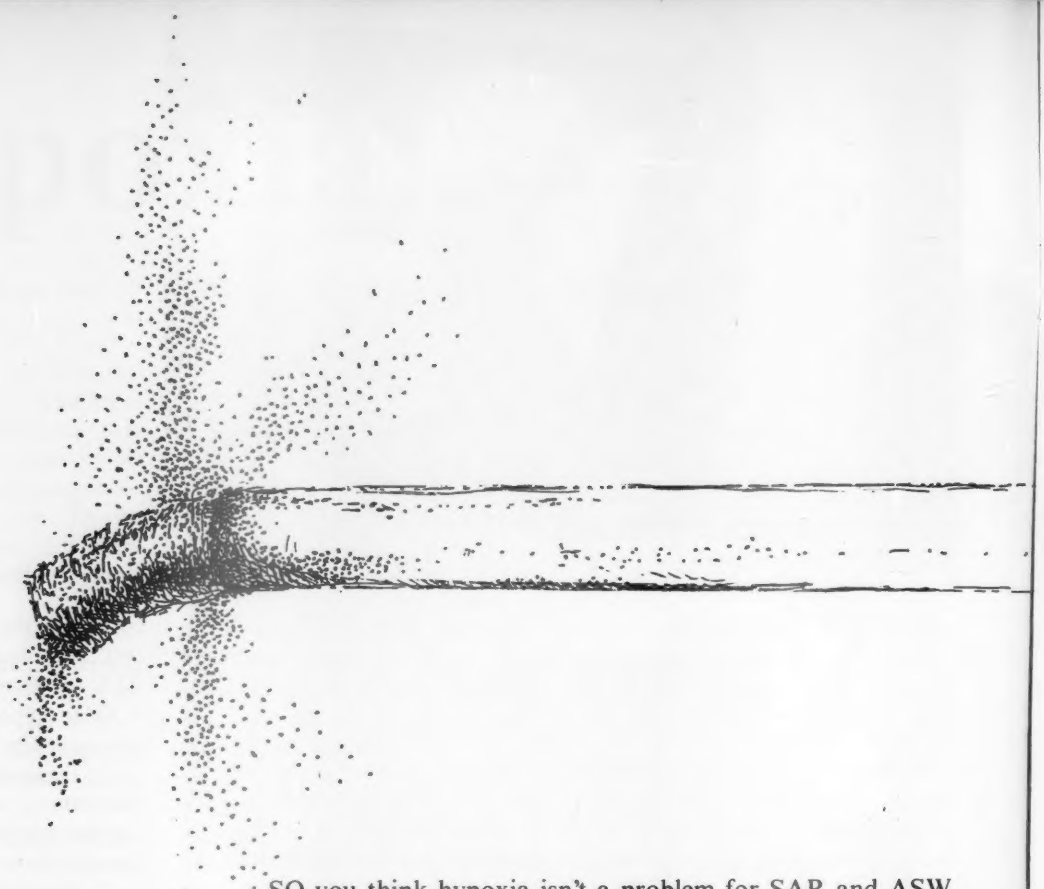
Once hypoxia begins, what do you do? Here are five steps:

1. Descend below 10,000 feet. Something may be wrong with the oxygen equipment or cabin pressurization system.
2. Go to 100 percent oxygen.
3. Check your oxygen equipment.
4. Control breathing to prevent hyperventilation. Pause-breathing for 3-5-second intervals keeps you under control and allows you to regain your composure.
5. Communicate. Alert other aircrew members and other aircraft in your flight. They may be able to help you. ◄

Ltjg. Lamanna is an aerospace physiologist with the Aviation Physiology Training Unit at NAS Norfolk.

Altitude	TUC
18,000 feet	30-45 minutes
25,000 feet	3-5 minutes
35,000 feet	30-60 seconds
43,000 feet	15 seconds or less

Note: During a rapid decompression, these times are cut in half.



Another Smokers Warning

By Lt. V.S. Warrington, RN

SO you think hypoxia isn't a problem for SAR and ASW crews? Don't kid yourself! On prolonged flights many aircrew experience symptoms of hypoxia as low as 7,500 feet.

"You don't fly that high?" Wrong again! Cigarette smokers maintain a blood level of carbon monoxide of between 5 to 10 percent saturation, simulating a physiological altitude of between 7,500 and 10,000 feet *at takeoff.* Just add this to your true altitude on your next flight and think again before you light up the next one. Remember it takes 20 minutes of 100 percent oxygen to wash the body clear of the carbon monoxide of just one cigarette.

If you are not sure about the symptoms of hypoxia, read on:

The earliest symptoms normally begin at between 7,500 and 10,000 feet, these being a reduction in night vision, impaired judgment, early fatigue and irritability. From 10,000 to 15,000 feet (physiological altitude), visual changes are more prominent with headaches, poor discriminating and a slowing of reaction time. The higher you go, the worse the symptoms become until you black out. These symptoms are insidious, and one must be constantly alert to their presence. Any increase in activity tends to accelerate symptoms of hypoxia. (Extracts from a U.S. Aviation Safety Council report.)

Lt. Warrington, an Exchange Officer from Great Britain, is Head of the Life Support Equipment Branch, Aircraft Maintenance and Material Division, Naval Safety Center, Norfolk, Va.

Perceptual Error

By Capt. James K. Haldeman, USMC

TWO naval aviators were killed in a mishap presumably caused by perceptual error. They became spatially disoriented, which caused a sensory illusion. This resulted in a slow reaction when they were in extremis.

The mishap investigation report concluded that the probable cause was pilot error for failure to recognize a deteriorating situation, spatial disorientation and vertigo, and visual illusions.

There were no witnesses to the mishap, and evidence was lacking; yet, investigators were able to speculate on the probable cause. The aircraft was in a G-induced maneuver with marginal visibility, possibly giving the pilots the perception that they were flying straight and level when they were actually in a steep, turning descent.

The pilot-in-command was a respected aviator who had consistently shown good judgement. In fact, his better qualities were observed at his briefings, which were strong in crew coordination, aircrew responsibilities and night operations. If it could happen to him, it could happen to anyone. Looking into this mishap has improved my safety awareness and understanding of perceptual error.

Perceptual error through spatial disorientation and visual illusions is a physiological problem to which all pilots are susceptible. It can throw off a pilot's orientation by causing illusions of vision, motion and body position with respect to an aviator's environment. Today's aircraft with high-speed capability about all three axes can make their pilots more vulnerable to perceptual error.

Early in my flying career, I learned that vertigo and other sensory problems were normal companions of flight. Most of my acquired knowledge was under limited flight conditions such as straight-and-level, 1-G and instrument flying. Now we come up against new problems with supersonic flight, high-G maneuvers in both horizontal and vertical planes, and engagements with aircraft at rapid closure rates. New problems with sensory perceptions begin to take focus.

It is called spatial disorientation: a person's false perception of his orientation in space. Our sense of balance or equilibrium is determined by three senses, all of which interact to give us a true spatial orientation. Vision, vestibular (semicircular canal sensation of acceleration) and proprioception senses (seat of the pants) all contribute. During flight when one or more of these senses are affected, sensory illusions occur.

There are many types of sensory illusions. Somatogravic illusions are false perceptions of the body's orientation to gravity. These occur in situations where visual cues are compromised; i.e., IMC or night conditions and after prolonged turns or turbulence when the aviator perceives himself as still in a bank. He will lean in the opposite direction of the perceived bank while he is actually in straight and level flight. This is appropriately called "the leans."

Somatogyral illusions occur during maneuvers of sustained angular motion such as coordinated turns, spins or rolls. These illusions result from the inability of the semicircular canals to register sustained angular velocity.

At the termination of these prolonged maneuvers, an illusion of turning in the opposite direction is produced. Unwilling to accept this sensation, the aviator is inclined to return to the original direction of motion, sometimes with disastrous consequences. Examples of this illusion are the "graveyard spin" and the "graveyard spiral." Autokinesis is an example of a visual illusion in which a stationary light appears to move in a dark sky.

. . . The aircraft was in a G-induced maneuver with marginal visibility, possibly giving them the perception that they were flying straight and level when they were actually in a steep, turning descent . . .

With today's high performance aircraft, illusions become more prevalent, especially in an emergency. It's important that pilots become aware of these possibilities, so they will react correctly. ◄

Capt. Halderman was the ASO for VMFA-235, when they were flying F-4Ss at MCAS Kaneohe Bay, Hawaii. VMFA-235 is transitioning to the F/A-18.

"The Flight Deck Is Open For Jogging!"

By Lt. R.P. Papadakis

A GOOD run on the flight deck does wonders for the body and mind out here in the middle of the North Arabian Sea. Not only does running help maintain your weight and reduce the risk of heart disease, it also improves your self-image: you feel good about yourself, and you are more productive at work and in your spare time. As a B/N, I feel more alert in my aircraft. Running on the flight deck is not without its hazards, however. You can get injured from running on a steel deck.

After touring a carrier, a young woman described it as "so metallic, so angular . . ." She couldn't have been more precise. The next time you run, keep in mind that the carrier environment is harsh and unforgiving. Our medical department described the most common jogging injury as "collision with inanimate objects." Joggers don't pay attention at times and run into objects much bigger and tougher than they.

The flight surgeons are happy to see physical fitness at sea, but they warn against knee injuries. The constant pounding against the flight deck puts a lot of stress on the knee. The soft tissue behind the kneecap acts as the fulcrum for this force as it is distributed throughout the leg by the quadriceps and the muscles in the lower leg. Damaging this soft tissue results in a syndrome described as "chondromalacia patella." If you experience *any* discomfort in the knee, stop running immediately and see your flight surgeon.

Our Handler has seen lots of runners, and he offers a few suggestions.

— Listen to the 5MC. Nothing angers the Handler more than those people who ignore the two most commonly heard calls: helo inbound, and turning aircraft.

— Give aircraft a wide berth during respot. If joggers get in the way of towed aircraft, the respot takes longer and joggers risk serious injury.

— If an alert is called away, go below immediately. Everyone is pressing to launch the aircraft; this is not the time to get in that one extra lap.

I offer the following do's and don'ts.

Do

— consult a physician before beginning a running program.

— wear the proper shoes when running. A shoe designed for running on hard surfaces is best.

— always stretch out before and after your run.

— always carry ear protection and wear it when necessary. Foam earplugs fit snugly in the waistband of your your shorts when not in use.

— keep an eye out for tractors. Give aircraft moves a wide berth.

— stay away from aircraft washdowns. The mist of the aircraft cleaner may blow into your eyes and could injure them.

— stay clear of aircraft refueling.

— keep your head on a swivel, and listen to the Air Boss and Handler on the 5MC.

— always run under control. A Bob Hayes sprint will probably end in disaster.

— be cautious around elevators. If the stantions are down, that does not always mean the elevator is on the O-4 level.

Don't

— don't run under tail hooks. You don't walk under them, do you?

— don't run anywhere near propellers. Treat all props as if they are turning.

— don't jump over tow bars or the down chains. This rule really applies toward the end of your run when you are tired.

— don't run between wing stations on aircraft. Meeting a wing pylon head-on is guaranteed to part your hair.

— don't run on catapult tracks. These are the most slippery surfaces on the flight deck.

— don't make sharp corners. You could fall on a slippery deck. If you are lucky enough for your foot to get a good grip, you are sure being rough on your ankles and knees.

Running on the flight deck is not just another jog in the park. With care, those on CV deployments can stay in shape. ◄

Lt. Papadakis is a B/N with VA-95.

The pilot's attitude of being able to roar with the lions and still fly with the eagles showed a blatant disregard for the rules of drinking and flying.

Drinking and Flying

By Cdr. R. Bason, MSC

CURRENT naval policy, OPNAVINST 3710.7M, prohibits consuming any type of alcohol within 12 hours of flight planning. Also, flight crews must make sure that they don't have hangovers prior to flight. The fallacy of this time limit from bottle to brief is evident.

First, the time for blood alcohol to clear depends upon how rapidly and how much alcohol is consumed. Secondly, blood levels depend on how quickly a person's body absorbs the alcohol; how long it takes to eliminate that alcohol depends upon the blood level and the person's metabolism. No set time period can apply to all situations and still be practical. Aviators must always remember that they may have alcohol in their blood, and that alcohol can affect their performance, even though they may not be aware of any effect. Flying performance can be significantly degraded by alcohol levels that would have no effect at sea level. Today's aviators have a "can do" spirit and a strong concept of

teamwork. They naturally tend to press on and overlook or not admit to hangovers.

All these factors came into play with fatal results when a helicopter flew into the ground shortly after takeoff. The aircraft was destroyed, and all on board were killed.

On the evening prior to the mishap, both the pilot and co-pilot of the mishap aircraft were at the Officers' Club. The pilot arrived at the club between 1630-1700, had dinner with the copilot and a friend, and departed for the BOQ approximately 2000. The copilot arrived at the club between 1700-1730. After having dinner, he went to the bar for drinks. According to witnesses, the copilot left the club at approximately 2200. At 0949 the next day, the aircraft took off. Approximately 24 minutes after takeoff (1013), as reconstructed by the AMB, the aircraft crashed into the side of a hill.

Based upon the nature of the copilot's injuries at autopsy, Armed Forces Institute of Pathology (AFIP) said he was flying the aircraft at the moment of impact. The AFIP studies also revealed the following:

a. All mishap victims died of initial impact from blunt force injuries.

b. There was no food in the mishap pilot's or copilot's stomachs.

c. The copilot showed an elevated alcohol level of .113 percent, .120 percent and .132 percent in his blood, urine and vitreous fluid.

d. The crew chief showed an insignificant amount of alcohol in his blood and vitreous fluid: .019 percent and .065 percent.

The alcohol level in the copilot's blood gives cause for concern since he was flying the aircraft at the time of impact. He was at the Officers' Club the night prior to the mishap, and according to witnesses, he had at least 5 to 8 beers and a couple shots of whiskey until 2200, when he left the club. Since a 0900 takeoff was planned for the next morning, the copilot had already violated OPNAVINST 3710.7M. The copilot arrived at 0800 the next day at air operations for a brief. After several weather delays, the aircraft took off at 0949, approximately 12 hours from the copilot's last drink. At 1600, approximately 18 hours after the copilot had consumed alcohol, samples containing alcohol were obtained from his blood, urine and vitreous fluid.

To give meaning to these findings, let's review a little "alcoholic physiology." Once alcohol is swallowed, it is rapidly absorbed into the blood stream from anywhere along the digestive tract. Absorption from the stomach takes place at a much slower rate than in the small intestines. The rate of alcohol absorption is influenced by such factors as volume, dilution of beverage, presence of food and the time taken to ingest the alcohol. Once the alcohol reaches the small intestines, its absorption is very rapid and complete; it is independent of the concentration of alcohol or the presence of food in the stomach or small intestines. Generally, a single dose of alcohol will reach peak level in the blood stream in about 60 to 90 minutes. Once in the blood, alcohol is distributed uniformly throughout all tissues and fluids of the body. In a 155-pound man, one drink (whether it is a 12-ounce serving of beer, a 3-ounce serving of wine or 1 ounce of hard liquor) represents a peak blood alcohol concentration of 0.02 percent.

The body eliminates alcohol through the lungs, kidneys and liver. Approximately 2-10 percent of the alcohol is eliminated from the body via the lungs and urine. Most of the alcohol is metabolized (broken down) by the liver, at a rate of .02 percent per hour. Therefore, it takes about one hour to metabolize the alcohol in one drink. Theoretically, if you were to imbibe one drink per hour, you would never get drunk. The rate at which alcohol is metabolized by the liver is not affected by food.

As the alcohol in the blood circulates throughout the body, it rapidly passes into the various tissues and fluids. One fluid of particular importance in accurately determining postmortem alcohol levels is the vitreous humor, the fluid inside the eyeball. Experiments have shown that alcohol in the vitreous fluid rapidly reaches equilibrium with the concentration in the blood. Thus alcohol in the vitreous fluid is representative of alcohol concentrations throughout the body. There is a theoretical relationship between vitreous humor alcohol and blood alcohol of 1.0 to 0.9. On the average, the concentration of alcohol in the blood is 0.9 times the concentration in the vitreous humor.

Everyone shows some degree of degradation of motor or sensory function at blood alcohol levels of .080 percent. At this level, which takes only four drinks, the person does not necessarily appear intoxi-

Table 1. Clinical States Related to Alcohol levels*

Blood (%)	Urine	Overall state	Clinical state
0.01-0.05 (10-50 mg%)	0.01-0.07	Apparently normal	No apparent influence, behavior nearly normal by ordinary observation. Slight changes detectable by special tests.
0.03-0.12 (30-120 mg%)	0.04-0.16	Likable	Mild euphoria, sociability, talkativeness; increased self-confidence; decreased inhibitions; diminution of attention, judgement and control. Loss of efficiency in finer performance tests.
0.09-0.25 (90-250 mg%)	0.12-0.34	Compromised function	Emotional instability; decreased inhibitions; loss of critical judgment, impairment of memory and comprehension, decreased sensory response; increased reaction time; some muscular incoordination.
0.18-0.30 (180-300 mg%)	0.24-0.41	Obviously impaired	Disorientation, mental confusion; dizziness; exaggerated emotional states (fear, anger, grief); disturbance of sensation (diplopia) and of perception of color, form, motion, dimensions; decreased pain sense; impaired balance; muscular incoordination; staggering gait, slurred speech.
0.27-0.40 (270-400 mg%)	0.37-0.54	Helpless	Apathy; general inertia, approaching paralysis; greatly decreased response to stimuli; marked muscular incoordination, inability to stand or walk; vomiting; incontinence of urine and feces; impaired consciousness, sleep or stupor.
0.35-0.50 (350-500 mg%)	0.47-0.67	Obtunded	Complete unconsciousness, coma, anethesia; depressed or abolished reflexes; subnormal temperature; incontinence of urine and feces; embarrassment of circulation and respiration. Possible death.
0.45+ (450 mg%)	0.60+	Lethal	Death from respiratory paralysis.

***Modified from Mohler — Mohler, S.R. Recent findings on the impairment of airmanship by alcohol. Officer of Aviation Medicine, FAA, AM 66-29 (1966)**

cated nor is he always aware of any intoxication. Table 1 shows the clinical states related to alcohol levels.

Armed with an understanding of alcohol physiology, let's examine the status of the copilot. What was the blood alcohol level of the copilot when he left the club at 2200? Let's assume that the mishap copilot drank eight beers and two shots of whiskey. The maximum blood alcohol, assuming no alcohol elimination via the urine or liver, would have been .20 percent (.02 percent per drink times 10 drinks). Now, the aircraft took off approximately 12 hours after the mishap copilot left the club and presumably had his last drink. Assuming that alcohol is metabolized at an average rate of .02 percent per hour, the copilot's blood alcohol should have been zero at takeoff.

However, we know that this was not the case. The alcohol level in the copilot's vitreous humor is a good representation of his blood alcohol level at impact, since he was killed at impact. After death, the body no longer metabolizes (breaks down) alcohol; furthermore, alcohol production as a result of putrefaction after death doesn't occur until tissue starts to decompose. The vitreous humor alcohol at impact was .137 percent. Assuming the body normally metabolizes alcohol at the rate of .02 percent per hour, he should have gotten rid of .24 percent alcohol at impact. Adding this to the .137 percent found on the vitreous humor, the copilot theoretically had a blood alcohol level at takeoff of approximately .337 percent. We know that this is not the case because at this level the copilot would have been unconscious, comatose and near death.

What can be said about the pilot's drinking prior to the mishap? Perhaps the pilot drank more than witnesses said. Or he continued to drink and was drinking faster than his rate of metabolism. Or he stopped drinking and then started drinking again, having a couple of beers. Whatever the situation, the pilot was under the influence.

Why would a well-trained, com-

petent pilot risk his career and his life by placing himself in the position of flying while under the influence of alcohol? The investigating flight surgeon indicated that the copilot had no single emotional, psychological or social problem that would cause undue conflict or stress and an increased alcohol use. The copilot had no history of alcohol-related problems. The flight surgeon said that, on looking at the overall personality of the copilot, he sensed "that he had an overabundance of a sense of invincibility, a feeling that he could handle anything, a feeling that whatever he jumped into, he could exit a winner."

These are fine qualities in an aviator, but they must always be tempered. This was one situation that he could not handle, where he was not a winner. Because of it, he will never again have the chance to be a winner.

Yes, you have heard this before: violation of NATOPS, failure to plan properly, supervisory error. The end result is tragic. In this mishap, seven lives and an aircraft were lost. No level of cockpit experience is enough if pilots flagrantly break the rules.

Cdr. Bason is Head of the physiology branch of the Naval Safety Center.

Fact or Fiction?

Myth: Beer is less intoxicating than wine or distilled liquor.
Fact: One 12-ounce beer contains the same amount of alcohol as 4 ounces of 12-percent wine or 1½ ounce of 86-proof liquor.

Myth: Diluting hard liquor slows the absorption rate.
Fact: Diluting an alcoholic beverage with water or fruit juice slows absorption. Mixing alcohol with a carbonated beverage increases absorption and intoxicates you more quickly.

Myth: A cold shower, coffee, physical activity or fresh air will sober you up.
Fact: Cold showers and coffee will only produce a clean, wide-awake drunk. Only your liver can detoxify alcohol. For each drink you consume, it takes approximately two hours to sober up.

Myth: A shot of brandy or whiskey will warm you up.
Fact: In moderate amounts, alcohol dilates the small blood vessels close to the skin, giving a deceptive "glow" of warmth. In fact, the dilated blood vessels reduce your body's ability to guard against heat loss.

Myth: Alcohol is a stimulent.
Fact: Alcohol is a depressant. It is absorbed directly into the bloodstream through the stomach. As blood circulates through your brain, the alcohol depresses body functions and learned restrictions on social behavior. Judgement, balance, vision and reaction time are affected almost immediately.

U.S. Coast Guard

1stLt. Michael C. Berryman, USMC
VMAT-203

Forty minutes after launching on an ACM sortie, and shortly after completing one engagement, 1stLt. Berryman's AV-8B's generator failed, followed almost immediately by the loss of all electrical power. Although his aircraft was flyable, 1stLt. Berryman could not lower the landing gear or flaps, or extend the speed brake. He also had no radios, stability augmentation, or any other way to monitor the aircraft instruments, except the pitot static instruments.

Using hand signals, he quickly told his flight lead about the problem, and the lead declared an emergency to MCAS Cherry Point tower, which cleared other aircraft from the landing pattern.

A vertical landing was the only choice with no landing gear, brakes or steering. 1stLt. Berryman estimated his fuel to be low enough to make a vertical landing and set the AV-8B up for the landing pad. During the decelerating transition, he tried repeatedly and unsuccessfully to pneumatically lower the gear with the emergency blow-down system.

1stLt. Berryman had only 55 hours in the AV-8B. Even though the winds were variable and gusty, he brought his aircraft into a stable, no-stabs hover over the pad. With the help of a landing site supervisor using hand and arm signals, he made an intentional gear-up vertical landing.

A decelerating transition to the pad with no stabs in gusty winds is no walk in the park. Combining other facets of this situation with an inexperienced pilot could have spelled disaster. Good hands and a good head prevailed. — Capt. Kyle Andrews, USMC, AV-8B Analyst, Naval Safety Center.

BRAVO ZULU

Lt. Thomas H. Chapin
VFA-132

Lt. Chapin was flying as Dash 2 on a three-plane low-altitude bombing mission at Pinecastle Target Range. As he completed the pull off target after his fourth run, his F/A-18's left inboard leading edge flap departed the aircraft. At 500 feet AGL and approximately 500 KIAS, the aircraft rolled violently to the left and 150 degrees angle of bank.

Lt. Chapin applied right stick and recovered wings level at 350 feet. He assumed initially that he had flown through the lead's jetwash, and he called up the FCS display to check for any flight control malfunctions. He saw no abnormalities, but sensed that the aircraft was handling in an unusual manner. He visually checked the condition of his aircraft and discovered the flap missing.

Initiating a climb and assuming the flight lead, Lt. Chapin proceeded directly to NAS Cecil Field while his wingman inspected the Hornet. He saw the damage to the left trailing edge flap, left fuselage, left horizontal stabilator and left vertical stabilizer.

After an incremental slow flight overhead Cecil, Lt. Chapin determined his minimum controllable approach speed to be 160 KIAS. He then completed an uneventful descent and visual approach to a short field arrestment. The cause of the flap failure is being investigated.

Left to right:
Capt. Michael Hinton, USMC,
Sgt. Jamie Brahan, USMC,
Sgt. Ronald Richardson, USMC,
Capt. Anthony Grzyb, USMC

Capt. Michael Hinton, USMC
Capt. Anthony Grzyb, USMC
Sgt. Ronald Richardson, USMC
Sgt. Jamie Brahan, USMC
HMM-162

Capt. Hinton (HAC) was the section leader of a flight of two CH-46Es participating in PHINIA 1-89 off the southern coast of Corsica. After launching at night from USS *Guadalcanal* (LPH-7), with 16 passengers simulating evacuees, the Sea Knights flew at 120 knots at 400 feet AGL over mountainous terrain.

Capt. Hinton and Capt. Grzyb (copilot) heard a loud bang, and their wingman reported seeing sparks coming from the No. 2 engine exhaust. Sgt. Richardson (crew chief) and Sgt. Brahan (aerial gunner) confirmed the sparks. Capt. Hinton traded airspeed for altitude while Capt. Grzyb secured the PMS.

The crew saw the No. 2 engine T5 passing 1,050 degrees C. and the Ng decreasing toward ground idle. Capt. Hinton told his copilot to secure the No. 2 engine, and as Capt. Grzyb did so, the T5 began decreasing. The crew watched for an engine fire light as they continued securing switches in the cockpit.

Capt. Hinton told his wingman to take the lead. The flight was approximately 30 nm from *Guadalcanal* and 20 nm from the small landing zone at the beach evacuation control center. The aircraft was also about 10 nm from an unlighted airfield on the western coast of Corsica. Capt. Hinton decided that the airfield would be the best choice, and the two helicopters headed for the site.

Sgt. Richardson and Sgt. Brahan told the passengers about the situation and briefed them for landing. Night Vision Goggles helped the crew see the runway, and Capt. Hinton made a running landing.

Lt. Jeffrey M. Hippler
Lt. Allen W. Baker
VT-23

Immediately after they launched from USS *Lexington* (AVT-16), Lt. Hippler and Lt. Baker were told by the Air Boss that their T-2's starboard main landing gear had departed the aircraft. Another squadron T-2 made a visual inspection and confirmed the wheel and brake assembly had left the main strut, but there appeared to be no other damage. Lt. Hippler and Lt. Baker assumed a dirty bingo profile as they headed for NAS Kingsville.

After reviewing NATOPS, the two aviators decided to raise the landing gear and make an intentional wheels-up landing. The field would de-rig the short-field arresting gear.

Arriving overhead, Lt. Hippler flew three practice approaches while burning up excess fuel. On his final approach, Lt. Hippler configured the aircraft with full flaps, speed brakes out, hook up and gear up. Lt. Baker assisted by calling AOA and airspeed from the rear cockpit.

Lt. Hippler flew a flawless approach with a minimum rate-of-descent, securing both engines just before touchdown. After touchdown, Lt. Baker secured electrical power and raised the canopy at approximately 60 knots. When the T-2 stopped, both pilots exited the aircraft, which had sustained only minimal damage.

Left to right:
Lt. Jeffrey M. Hippler,
Lt. Allen W. Baker

Are Lasers in Your Future?

By Lt. Richard Erickson, MSC

IN March 1987, then-Secretary of Defense Caspar Weinberger announced that the Soviets have the technological capability to deploy low-power lasers as anti-personnel weapons. Lasers are no longer simple components in other systems, such as target designators or rangefinders. They may now be dedicated weapons. Weinberger said that a Soviet military laser had been used to illuminate a patrol aircraft and its crew. We know the Soviets have installed lasers on their *Sovremenny*-class DDGs, and that other ships may also be similarly equipped. The implication is clear: Aircrew and, perhaps, surface crews, may be subject to the potentially hazardous laser.

Few of us know much about lasers, so let's start with a few facts. Laser light can be aimed at a source many miles away and maintain most of its energy since the light beam does not spread very much.

A high-powered laser at close range can cause permanent eye damage. If the periphery of the retina is hit, you will not even notice a blind spot. But, if it hits your fovea, the damage could be greater and affect your sight.

Lasers operate in two modes: continuous or pulsed-wave. A continuous-wave (CW) laser produces light constantly, although it can be interrupted to make flashes. Pulsed lasers release their energy in short bursts that usually last only a few thousandths, millionths or billionths of a second. The peak power of a pulsed laser — because of its short bursts — can be much greater than a CW. If the pulse repetition rate is greater than 30 per second, the pulses will merge, and the beam will appear continuous.

A small band of the electromagnetic spectrum is visible to the unaided eye. This band is described either by frequency in cycles per second or by wavelength in nanometers. Lasers are usually referred to in terms of their wavelength.

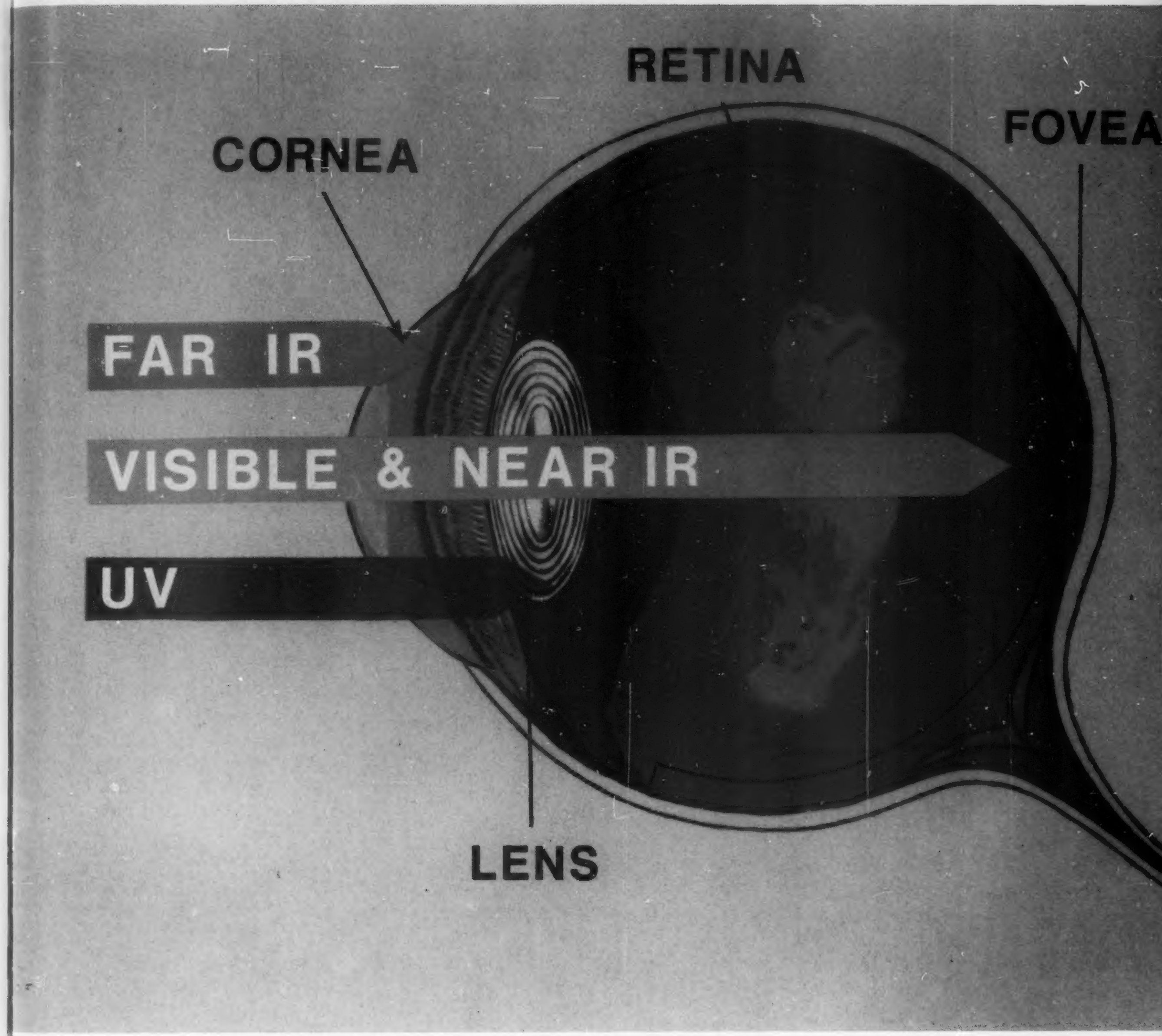
Probably the most important characteristic of laser light is that it is of a single wavelength. The wavelength for each type of laser depends on the lasing element or material. The transmission and absorption characteristics of each wavelength defines the hazard to our eyes.

Light enters the eye through the cornea and the lens to reach the back of the eye, the retina. The cornea and the lens concentrate this light on the fovea, at the center of the retina. Consequently, this makes the eye susceptible to lasers or any high-intensity light.

Let's review the effects of laser energy on the eye.

1. UV wavelengths are absorbed by the cornea or lens, and do not reach the retina.
2. Visible wavelengths pass through the cornea and lens, and are absorbed by the retina.
3. Mid- and far-infrared wavelengths are absorbed by the cornea and do not reach the retina.

For our purposes, eye problems can be divided into four categories: glare, localized light adaption or



flash blindness, retinal damage, and corneal damage. Depending on the power of the laser, at far distances or very low energy, a visible beam can cause glare — sometimes called dazzle. During the day, only part of your field of view will be obscured if you look directly at the beam. However, at night, things are different. Your entire field of view may be blocked by glare. Laser glare can be an annoyance, and if the power is great enough, it can cause you to abort your mission.

Higher powered lasers can cause flash blindness. You temporarily lose your vision. It's like what happens after someone takes a flash photograph. Neither glare or flash blinding result in permanent eye damage; however, if lasers were used as a defensive tactic, they could cause you to pull up, abort the mission, and perhaps place you and your aircraft in the enemy's defense envelope.

A high-powered laser at close range can also cause permanent eye damage. If the periphery of the retina is hit, you will not even notice a blind spot. But, if it hits your fovea, the damage could be greater and affect your sight.

Continued

The invisible laser will cause corneal clouding, obscuring your vision. Remember, visible lasers cause retinal damage with no pain, and invisible lasers cause corneal damage, which is extremely painful.

Viewing a laser through a magnifying glass increases the light concentration, and thus, potential for eye damage. A good rule of thumb is not to look at lasers through any direct-view magnifying optics.

What can we do to protect ourselves against lasers? The obvious answer is to wear eye protection or not to look at the laser. Protection against specific wavelengths can be engineered into spectacles, visors or goggles. Sunglasses, dark, mirrored or aviator's tinted helmet visors, give little protection; but they are better than no protection at all — but not much.

Lasers are now a threat. We must recognize this fact. They can cause temporary glare, dazzle and flash blindness, *or* permanent problems. The eye can repair itself; however, if the laser damages retinal nerves, the eye cannot regenerate nerve endings. You should wear eye protection and use common-sense measures. Report all laser sightings as part of your mission debrief.

Additional information is available from two videotapes. Write the Joint Visual Information Activity, Tobyhanna, Pa., or call Autovon 795-6543. Ask for "Lasers in Military Operations, Part I" and "Part II," SAVPIN Nos. 803562DN and 803563DN.

The author would like to acknowledge the assistance of Lt. Col. R. Cartledge, USAF; Mr. John Gordon, Naval Imaging Command, and Lt. M. Wilkinson of MAWTS-1 and Aviation Life Support Systems Branch (AIR 5311), NAVAIRSYSCOM.

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Stress:

Two Discussions

Detecting Stress

By Lt. Nels A. Frostenson

ALTHOUGH some stress is necessary in daily life, excess stress can lead to mental and physical breakdown. In an atmosphere like naval aviation, which requires quick responses to life or death situations, these breakdowns can cause mishaps.

The signs of stress often go unnoticed. They include sleeplessness, headaches, dryness of the throat and mouth, anxiety, trembling hands, pain in the lower back, impulsive behavior, fatigue, and stuttering speech. Stress affects the workcenter and results in poor production and difficult relationships with workers.

Half of the causes of stress are life-style choices, clearly indicating that we are the managers of our own welfare. People must learn to manage excess stress because it drains the body of energy. The results of unmanaged stress are alarming. The most profound and immediate results are job dissatisfaction, job tension, low self-esteem and high-cholesterol blood levels. Long-term devastation comes in other forms, such as coronary diseases, apathy, mental illness, frequent and severe accidents.

In our daily lives, manageable stress creates an incentive to work and perform. The bottom line behind stress being a life-style choice is that stress *is* manageable and useful.

Research shows that those people who best resist stress were actively involved in work and social activities, more oriented toward challenges, and felt in control of their lives.

The war against stress begins with these simple actions: regular exercise, proper nutrition, relaxation, self-awareness and enjoyment of life.

Lt. Frostenson is an ECMO with VAQ-135. He is the squadron Admin Officer.

Coping With Stress

By Lt. C.J. Boblit

EVERY naval aviator has heard a lecture on the effects of stress on performance. The high-stress events in your life include death of a loved one, divorce, buying or selling a home, moving, job changes, and new additions to the family. These events are obviously stressful. The carrier aviator would probably add family separation and night traps to this list. There are less obvious daily stress factors, however.

Simply put, stress is discomfort. Discomfort comes in many forms, from a hot cockpit on the flight deck with the canopy closed, to a lack of sleep due to contingency planning and early briefs. As aviators, we are intimately familiar with stress, and in that familiarity there is danger.

Placed in a chronically uncomfortable situation, we are faced with two subtle hazards. One is that we tend to regress psychologically under stress. We become irritable, cranky or overly sensitive. Stress challenges our maturity. An immature pilot is an unsafe pilot.

Secondly, in order to survive stressful situations, it is normal for a certain amount of psychic numbing to occur. Although necessary and healthy, this self-anesthesia may lead you to believe you are up to speed and able to hack the program when you can't.

Put a 25- to 30-year-old, healthy, athletic male in a situation (over two months on Gonzo Station as I write this) of prolonged abstinence from sex, beer and ball games, and we have a true case of stress. Add irregular sleep, strike planning, canceled ports, integrity watches and not a single minute to yourself, and you have the opportunity for stress and psychic numbing.

Flying around the ship, we Naval Aviators pride ourselves on our ability to get the job done and to overcome stress. We rise to the challenges. But the dangers I've mentioned infect us like an invisible virus. The daily discomforts of prolonged life at sea become so routine that the real danger is *not recognizing your condition.*

So, the next time you don't get mail, or the bug juice tastes like dishwater, or the 5-MC blasts your ears as you transit the catwalk to man up, take a deep breath and remember the dangers. Be mature and realize that you are in a stressful situation that you need to recognize and overcome.

Lt. Boblit flew A-7s with VA-146 when he wrote this article.

Docs Talk Blocks

By Lt. Russ Lawry, MSC, and Lt. Treina Melson, MSC

The flight attendant on a C-9 developed an ear block while the aircraft descended into an NAS on the second leg of a flight. He began to feel pressure 50 minutes into the flight but was able to clear his ears using valsalva. However, halfway through the descent, the pressure developed again, and this time, the crewman could not clear his ears. After landing, he was brought to medical, but the corpsman could not relieve the pressure.

The flight attendant then went by helicopter to the station's pressure chamber where he was given nasal spray. A Politzer bag was also used to try relieve pressure in the eustachian tube — all unsuccessfully. He next went to a naval hospital for decongestants and pain medication. After spending the night in a hotel, he returned to his base by bus, a 28-hour trip.

The interesting thing about this incident is that there was no prior indication of cold symptoms or sinus infections. So, if this happens, what can you do? Tell the flight crew. If you don't speak up, they can't help. The flight attendant said nothing. Once they are aware of the problem, the crewmembers have several options.

The pilot can level off and allow you to try to equalize the pressure by valsalva. If you find the pressure is too great at that level, the pilot can climb until the pressure allows you to do a successful valsalva. Once you hear that "click", the descent can continue at a slower rate. If you're congested to the point that you block repeatedly, don't worry. There are a couple more tricks to try.

If you're unsuccessful with the initial procedures, climb until the pressure subsides. Put on an oxygen mask, and select the emergency setting on the MD/CRU-series regulator. Then, swallow. This should produce a more effective valsalva. When using the full-face oxygen and smoke mask, such as that found on P-3s, just hold the mask to your face and close off the exhalation port. When using the Sierra Quick-Don mask on C-9s, put the mask on completely.

A final mechanical approach in C-9s and P-3s is the 8-oz. Politzer bag in place of the oxygen regulator. The portable bag is safe and easy to use. The Air Force has a similar device in their altitude chambers, and the Navy now uses it, too. The Politzer bag accomplishes the same thing as the emergency oxygen method, but is much more portable and versatile. The olive-tipped nasal cannula is placed into one nostril, then both nostrils are held closed. The patient swallows as the bulb is squeezed. This action forces air into the middle ear via the eustachian tube, effectively neutralizing the ear block. With proper training, crewmen can use the Politzer bag to safely relieve ear or sinus blocks when using the oxygen regulator may not be effective.

Following your flight surgeon's recommendations, and squadron SOP, Afrin or Neo-synephrine may be considered in an emergency. This is a last-ditch treatment that is recommended as a possible treatment for ear blocks on jet aircraft in "Ear Blocks" in the September 1988 issue of *Approach.*

We strongly urge that the Politzer bag be incorporated into the standard first aid equipment onboard all C-9s and P-3s. This item will help treat ear and sinus blocks and reduce the possibility of more serious injuries to affected tissues.

Lt. Lawry and Lt. Melson are Aerospace Physiologists at NAS Cecil Field. Though stationed at a jet base, they also work with squadrons in the prop and helo communities.

The Local Board of Flight Surgeons Can Help

By Capt. M. Hollis Tanksley, MC

WHEN a safety survey team visits a squadron, one of the areas discussed with the CO, XO, and Ops O is how much flight time is lost to down time for conditions requiring a medical waiver. Surveys have found that this down time is generally excessive, sometimes requiring 90 days to get a waiver for certain medications for hypertension, mild chronic inflammatory conditions, or other waiverable conditions requiring grounding.

The 90-day period does not begin until the flight surgeon determines that the aviator is safe to fly with the medical condition. After all the information is evaluated and the waiver request sent to NAVMEDCOM Code 236 at the Naval Aerospace Medical Institute (NAMI), the decision is made based on reports and the flight surgeon's recommendation. This procedure requires time to go through the various office baskets, the CAG and type commander, before going to NAMI. Only after the waiver recommendation by NAVMEDCOM goes to NMPC is the grounded aviator permitted to fly.

This excessive time can be reduced to nearly zero if the Aeromedical Safety Officer and Flight Surgeon advises the CO to use the local board of flight surgeons.

The local board of flight surgeons is convened by the CO, usually on the squadron Flight Surgeon's recommendation. The board's purpose is to render a medical decision on the flight status of squadron aviators. This board is covered in the *Manual of the Medical Department 15-80*, Paragraph (1). Only the squadron CO or higher aviation authority can convene the board which should consist of three flight surgeons, if available. Aviation Medical Examiners, Aviation Medical Officers or other medical examiners may fill two of the seats if flight surgeons are not available. The senior flight surgeon member shall function as the senior member of the board. Under adverse conditions, one flight surgeon or aviation medical examiner may be considered sufficient to constitute the local board of flight surgeons.

This board is designed as a speedy, effective way to alleviate administrative down time. The board's decision is effective immediately and cannot be reversed except by NAVMEDCOM Code 236. If NAVMEDCOM does reverse the decision, the CO of NAMI usually convenes a special board at NAMI.

The Naval Safety Center recommends that a local board be used to determine the flight status of all grounded aviators requiring a waiver. This procedure will reduce the down time and allow the squadron CO to use his local flight surgeon's expertise.

The survey teams have found several instances where the flight surgeon has placed his CO at risk by giving an up-chit to an aviator with a medical problem which Code 236 has told him would be waived. An up-chit based on verbal recommendations, not officially waived by NMPC or a local flight surgeon board, constitutes a written recommendation to the CO clearing the aviator for flight. This is in direct violation to existing instructions. If the cleared aviator is involved in a mishap, the verbal recommendation may be hard to verify for the mishap board. The CO and his flight surgeon would probably bear the full responsibility for allowing someone to fly without being officially qualified.

Remember, the local flight surgeon board was established to permit a local commander to handle a local problem in the shortest time with minimal effect on operational readiness and mission capabilities. As the Aeromedical Safety Officer and Flight Surgeon, you were sent to a highly specialized school at NAMI for six months to give you the knowledge and insight to assist your CO and squadron mates in all areas of aeromedical safety. These areas include personal health, advice for dependents, training programs in related areas, and early recognition of impending problems that only a trained individual like yourself can detect.

Aeromedical safety begins with allowing only those people who are physically, emotionally, and physiologically qualified to enter flight training. Safety continues as the Flight Surgeon makes recommendations for groundings, and gives up-chits on a day-to-day basis. The aviator is not safe to fly until the temporary condition is corrected. Down-chits may be given for physical illness or emotional problems such as recovering from an accident, surgery or the effects of medication.

The most important thing to remember is that whatever the reason for grounding, it was done in the interests of aeromedical safety. The aviator should be returned to flight status as quickly as possible to minimize the effect on operational safety.

Capt. Tanksley is Head, Aeromedical Division of the Naval Safety Center.

LETTERS

Re: Slip Sliding Away, Slip Sliding Away (Oct '88)

NAS Miramar, Calif. — Lt. Benham's article has an error in the section on "personal flight gear preflight." He states, "Strobe batteries (should flash 50+/-times in two minutes)." This is incorrect.

The strobe *light* should flash 50 times +/-10 flashes in *one minute* for a two-minute duration. The strobe light batteries expire three years from the date of manufacture, printed on each battery.

You should make sure that a 1.5-inch by 3-inch piece of hook tape (Velcro, male) is glued to the strobe light, or the pile tape (Velcro, female) glued to your helmet visor will not do you any good. Also, the strobe light should be stowed with the dome end in the down position.

PRAN John E. Chouteau
Parachute Riggers Shop
VF-211

Where Are the Instructions?

NAS Willow Grove, Pa. — I'm a pilot with VP-64, a reserve P-3 squadron. During the past four years, we have had three modifications to our aircraft: a wheels warning system, an ARC-182 installation and recently a KY-75/ICS modification. In all three cases the aircraft were modified, but no supporting documentation was given to the squadron, either for maintenance or aircrew.

Our maintenance department borrowed the mod team's wiring diagrams to make copies so we would have something to use for trouble-shooting. The wheels warning system has finally been added to NATOPS.

All of these systems directly affect the safety of flight (SOF). There is no excuse for not supplying the documentation to us during the modification. It shouldn't take years for this important information to be added to NATOPS.

While the first two mods were not complicated, the KY-75/ICS is complex. It affects not only our SOF but also COMSEC security. The lack of documentation severely restricts our training and also limits our maintenance trouble-shooting. We leave on a cruise soon. Wish us luck!

LCdr. Edward Whalon
VP-64

• Excellent point. Four years from modification to publication is unsat — not just from an administrative standpoint, but safety as well. Although there is a wide variety of reasons for the delays, several steps are being taken to resolve the problem. First, interim support plans (ISPs) are to be provided to each squadron by the modification team. These plans include wiring diagrams and schematics, which enable maintenance personnel to safely trouble-shoot until publication changes are issued. Also, the staff at the NADEP Publication Department has been increased to improve timeliness. The next step will occur during the next P-3 Safety System Working Group meeting when this hazard and associated causes will be addressed. — Lt. Ken Underwood, P-3 analyst, Naval Safety Center, Norfolk, Va.

Out of Control

Monterey, Calif. — Many Navy aircraft mishaps are related to out-of-control flight. Such uncontrolled flight might be caused by a system failure where the mishap pilot lost control because the aircraft didn't do what he expected it to do.

Such mishaps have involved crew coordination or these NATOPS gray areas: asymmetric thrust, stall or spin vs. spiral, wing vortex avoidance, flight lead and wingman coordination, LSO and ground controller responsibility along with basic airmanship. Aircrews should study these areas and emphasize them in crew briefings and assignment of responsibilities.

There are certain phases of flight that are particularly dangerous and need more command attention: low transitions, early or high G turnouts, unauthorized air shows, training below minimum altitude limitations, misuse of stability augmentation systems and aircraft configuration, unauthorized or incorrect flight support equipment and shortcutting checklists.

Each aircraft and aircrew has a specific flight profile envelope. When it is exceeded, the unexpected often happens. Test pilots are paid to explore unproven techniques. Fleet aviators are paid to complete the assigned mission in order to improve combat readiness.

Cdr. S.W. Schreckengast
Aviation Safety Programs
Naval Postgraduate School

AN Michael J. Fiedler

"What did you say?"
"I said 1-800-HOT-SFTY."
"Hot what?"
"No. No. It's a phone number. 1-800-HOT-SFTY."
"I don't hear a phone."
"I know, but if you have any questions about safety, just call."
"Who?"
"The Naval Safety Center, that's who."
"Why?"
"If you have a question on safety."
"There's no question about safety here."
"I know, but just if."
"If what?"
"If you have a question."
"What was the number again?"
"1-800-HOT-SFTY."
"1-800-HOT-SFTY?"
"1-800-HOT-SFTY."
"That's easy enough."
"I know."
"I'm glad. Now get back to work. We've got to stop meeting like this."

BROWNSHOES IN ACTION COMIX

"The kind real aviators like"
By Lt. Ward Carroll

The Day the Docs Walked (almost)

They had reached the end of their surgical tubing . . .

Had there been too much teasing? Aviators were caught off guard. Realizing the need for aerospace medicine, they quickly developed a new streamlined annual flight physical.

Fortunately, the potentially disastrous situation was remedied when skeds writers throughout the fleet put their flight surgeons on the schedule the following day . . .

PROPELLER

Prop Tips

Faster than a speeding bullet.

DANGER

They can stop you dead in your tracks.

Poster idea contributed by Lt. Vesterman, VA-95 Safety Officer